



## Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact [support@jstor.org](mailto:support@jstor.org).

*A letter from David Rittenhouse, A. M. of Norriton, to William Smith, D. D. Provost of the college of Philadelphia; containing observations of the COMET, which appeared in June and July, 1770; with the elements of its motion, and the Trajectory of its path. Communicated to the Society, August 3d, 1770.*

REV. SIR,

HEREWITH I send you the fruit of three or four days labour, during which I have covered many sheets, and literally drained my ink stand several times. It is an account, &c. of the COMET which lately appeared, and I have no objection to its being made public. I might, indeed, have been a little more careful to have the precise time of my observations, as the near approach of this Comet required ten times the accuracy, that is necessary for computing the place of any planet. I am, however, quite satisfied that the situation I have given its orbit will be found very near the truth.

THE circumstances most remarkable in this Comet were, its prodigious apparent velocity, the smallness of its size, and the shortness of the time it continued visible. Its velocity was at first surprisngly accelerated, and before it disappeared again retarded, from which its near approach to the earth may be inferred.

I did not see it till Monday the 25th of June; and, from its situation at that time, I expected it would have been visible for many weeks, if not months; and therefore did not prepare, with such expedition as I might have done, for observing its place with accuracy. But from the 27th to the 30th, the weather continuing fair, every evening about nine, I took the distance of the Comet from *Lucida Lyræ* and *Lucida Aquilæ*, with a common Hadley's Quadrant.

JULY the first, it was cloudy in the evening. At 10 however, I saw both *Lucida Lyræ* and the Comet through the clouds, and observed their distance; but the Comet was again hid before I could take its distance from the Pole star, which seemed to be about 5 or 6 degrees. This evening it was distant

tant from Lucida Lyræ  $49^{\circ}. 17'$ . whereas the evening before it had been but  $5^{\circ}. 42'$ . from the same star at 9h. It had therefore moved above  $45^{\circ}$ . in the last 25 hours, and now appeared much brighter than it had been before; there being also some appearance of a tail on the side opposite to the Sun. July the 2d it was cloudy with rain in the evening; but in the morning of the 3d about 3h. I observed its distance from the Pole star, from Capella, and from a star of the second magnitude in Cassiopeia, which was the last time I saw it.

FROM the above observations, and many very laborious calculations, I have endeavoured to settle the elements of this Comet's motions (supposing it to move in a parabola, and to be governed by the Sun's attractive force) as follows, viz.

The place of the ascending node	-	Leo	$14^{\circ}. 21'. 45''$ .
The place of the perihelion	- -	Pisces	$26^{\circ}. 19'. 28''$ .
Inclination of the orbit	- - -		$1^{\circ}. 49'. 5''$ .
Perihelion distance from the Sun,			
in such parts, as the earth's			
mean distance is 100000			
$\left. \begin{array}{l} \text{in such parts, as the earth's} \\ \text{mean distance is 100000} \end{array} \right\} 62757,5 \text{ Log. } 9.7976653$			
The logarithm of its daily mean motion	- -		$0.2636300$
Time of the Comet's being in perihelio,			August 8th, 19h.
26'. equal to August 8.80965			
Its motion direct; that is, according to the order of the signs.			

FROM these elements, and Dr. Halley's *Tabula Generalis Motuum Cometarum, in Orbe Parabolico*, it will be easy to compute this Comet's visible place for any time; during its stay in the planetary regions, in this manner.

FIND the difference between the time proposed and the time of the perihelion; that is, August 8. 80965, in days and decimal parts of a day; and to the log. thereof add the log. of the daily mean motion. The sum is the log. of the mean motion from the perihelion. To the mean motion so found, take the angle corresponding out of Dr. Halley's table above-mentioned, which angle being added to or subtracted from the place of the perihelion, as the time proposed is after or before August 8th, 19h. 26', gives the heliocentric place of the Comet

Comet in its orbit ; and, as that is so nearly parallel to the plane of the ecliptic, I have, for the more easy calculation, neglected the reduction entirely, which could scarcely exceed  $50''$  at any time. Likewise, to the mean motion, take out of the table aforesaid the *Logarithmus pro distantia à sole* ; from which subtract the compliment of the log. of the perihelion distance, viz. .2023347 always, and you have the log. of the Comet's distance from the Sun. The inclination and geocentric place may then be found by the same method we use for the planets.

Example. Let the visible place of the Comet for June 27th, 96. be required. From August 8. 80965

Subtract June 27.	375		
Remain Days	42. 43465	log.	1.6277207
Log. daily motion add	-	-	0.2636300
Mean motion before perihel.	77.86652.		1.8913507
Angle corresponding	80°. 5'. 12''	Log. pro distantia	5.2320440
Sub. from perihelion	26°. 19'. 28''	Compliment log. perihelion dist. subtract	.2023347
Remains the Co- met's heliocentric longitude	53°. 6'. 14". 16''	Comet à ☉	107082.2 Log. 5.0297093
Sub. from longitude ☉	53°. 6'. 16". 7'	☉ à ☉	101678.2 Log. 5.0072280
Difference	= 1'. 51''	Comet à ☉	5404. Log. 3.7327153
Add the Log. of ☉ distance à ☉		Tangent	6.7308977
			5.0072280

Sum	11.7381257
Subtract the Log. of the Comet à ☉	3.7327153

Remains Tangent	8.0054104	
Which sub. from	53°. 6'. 14". 16''	The heliocentric longitude.
Remains	53°. 5'. 39'. 28''	The Comet's visible place.
Place of the node	14°. 21'. 45''	Descending.
Argument of lat.	38°. 7'. 29''	Sine 9.7905493
+ Sine inclin. of orbit	1°. 49'. 5''	8.5014111
— Rad. = Sine heliocent. lat.	1°. 7'. 20''	8.2919604
Tangent ditto		8.2920434.
+ Log. Comet à ☉		5.0297093

Sum	13 3217527
Log Comet à ☉ = 3.7327153	Sub. 3.7327668
+ Secant 34'. 48'' — Rad. = 515	
Remains Tangent visible lat.	21°. 13'. = 9.5889859

## Observed distances of the COMET,

From	Lucida Lyra.	Lucida Aquil.	Capella	In flexura ad Coxas Cassiopeiæ.	Longitude observed.	Longitude computed.	N. Lat. observed.	N. Lat. computed.
D. h.								
June 27. 9.	40°. 44'	22°. 6'	---	---	♊ 5°. 41'	♊ 5°. 39'	21°. 15'	21°. 13'
29. 9.	22. 25	18. 8	---	---	♊ 10. 9	♊ 10. 12	39. 21	39. 47
30. 9.	5. 42	34. 50	---	---	♊ 23. 36	♊ 23. 38	64. 0	64. 0
July 2. 15.	---	---	---	12°. 7'	♊ 24. 32	♊ 24. 35	33. 50	33. 29
3. 15. $\frac{1}{2}$	95. 56	---	---	8. 18	♊ 27. 29	♊ 27. 29	21. 30	21. 35

*This last Observation was taken by the Rev. Mr. EWING.*

IN making the above observations, the time (as hath been already hinted) was not strictly noted to minutes; and therefore a *perfect* agreement, between the *observed* and *computed* places, cannot be expected. Besides, the Comet approached so very nigh, that an error of 1'. in computing its heliocentric place, might produce an error of a degree in its visible place, and more than two degrees in its longitude in the signs.

IT is remarkable of this Comet, that in any future returns, whilst it continues to move in the same orbit, it can never approach the earth nigher than it did this time. On the first of July, it was about one sixtieth part of the Sun's distance from us.

*Perhaps, if the apparent distance of the NUCLEUS, from some fixed star near which it passed, had been measured with a micrometer, at different places on the earth conveniently situated, the SUN'S PARALLAX might, by this means, have been determined nearer than we can ever hope for, by any other method.*

THIS Comet, notwithstanding its nearness, appeared but small, and continued visible but a few days; and, in all probability, had it passed the earth's orb but three weeks sooner, we should never have seen any thing of it. This affords ground for a probable conjecture, that there are numbers of these wandering bodies, which traverse the vast space encircled by the planets, entirely unperceived by us. I remember one, about ten or twelve years ago, that appeared much smaller than this, moved very fast, and disappeared in a few days like-wile.

NOTHING

NOTHING but the smallness of the present Comet can prevent its being seen at this time (if indeed it be not seen); for it must rise in the morning before day, and continue to do so for some months; but will at length retire to a prodigious distance, beyond the reach of the best glasses, in the 26th degree of virgo, and very little north of the ecliptic.

THE earth's place June 27th, 14<sup>h</sup>. at the meridian of Greenwich, is computed to be 9<sup>s</sup>. 6°. 16'. 7", and the excentricity of its orb 168 such parts, as its mean distance is 10000. If any one would compute the visible place of the Comet, from the principles above laid down, he must find the Sun's place, or rather the earth's, by the tables he makes use of, to June 27, 14<sup>h</sup>. at Greenwich, and as much as he finds it faster or slower than 9<sup>s</sup>. 6°. 16'. 7", so much must he add to, or subtract from, the place of the perihelion, not neglecting seconds, otherwise a very great difference might arise in the calculation.

IF the reduction to the plane of the ecliptic be applied, 50" may be subtracted from the place of the perihelion.

NORRITON,  
July 24, 1770.

D. RITTENHOUSE.

L E T T E R II.

DEAR SIR,

I WAS much pleased with a paragraph in the Gentleman's Magazine for July 1770, by which it appears, that M. Messier discovered the last Comet in France 10 or 12 days sooner than we did here; because it affords another opportunity of comparing this Comet's motion with my theory.

ACCORDING to M. Messier's observation, on the night between the 15th and 16th of June, the Comet's right ascension was 272°. 57'. 37" with 15°. 55'. 24" South declination. The hour of the night is not mentioned, but the place of the  
o f Comet

Comet was no doubt determined by its passing the meridian, which he says was about midnight, that is at Philadelphia June 15th, 7<sup>h</sup>

Time of the Perihel. Aug. 8. 8096  
Subtract, June 15. 2916

Remain Days, 54. 518 Log. 1,736540  
Add the log. of the daily mean motion, 263630

Mean motion, 100,04	Log. 2,000170		
Angle corresponding 90°. 0'. 54"	Log. pro Distantia à Sole	Subtract, - - -	0,301260
Which sub. from the perihel. } 356. 19. 28			202335
Comet's heliocent. long. 8s. 26° 18' 34" = 266. 18. 34	Comet's dist. from ☉ = CS 125,581	Log.	0,098925
☉ do. 8. 24. 44. 53	Earth's distance from do. 101,627	Log.	0,007011
differ. 1. 33. 41	Secant, 1°. 33'. 41" — Rad. sub.		161
Let S, (Plate I. Fig. 3.) be the place of the Sun; E, the place of the Earth; and C, of the Comet.	P S - 101,590	Log. - - -	2,006850
	Sub. frm CS = 125,581	+ Tang. 1°. 33'. 41"	8,435490
	Rem. CP = 23,991	Sum,	10,442340
		Sub. CP. Log.	1,380048
	Remains Tang. ECS = 6°. 35'. 3"		9,062292
	+ heliocent. long. 8s. 26°. 18'. 34"		

The Sum is the geocent. place of Comet, 9s. 2°. 53'. 37"

Long. of the descending node 10s. 14°. 22'. 45"  
Sub. heliocent. long. of Com. 8. 26 18. 34

Argument of latitude, 48. 4. 11 Sine, 9,871548  
+ The Sine of the inclinat. of orbit, 1. 49. 5 8,501454  
— Rad. = Sine heliocent. latitude, 1. 21. 9 - - 8,373002

As the cosine of 6°. 35'. 3" = ECS 9,997126  
is to Radius - - - 10, - - -  
So is CP = 23,991 - - - 1,380048

To CE = 24,15028 - - - 1,382922

As CE = 24,15028 - - - 1,382922

To CS = 125,581 - - - 2,098925

So is tang. heliocent. lat. 1°. 21'. 9" = 8,373091

10 472016

To the tang. of the } 7°. 0' 9,089092  
geocent. lat. }

Hence the visible place of the Comet was 12° 2°. 53'. 37" with 7°. 0' North latitude. The right ascension and declination I find as follows.

Let

Let C, (Plate I. Fig. 4.) be the place of the Comet; A, the first point of Aries; AP, a portion of the ecliptic; CP, perpendicular to it; AR, part of the equator, and CR, perpendicular thereto. Then shall AP, be equal to the complement of the Comet's longitude= $87^{\circ}. 7'$ , and PC, its North latitude = $7^{\circ}. 0'$ . AR, the complement of right ascension; and RC, the declination.

$$\begin{aligned} \text{Cofine AP} &= 87^{\circ}. 7' - - - 8,701589 \\ + \text{Cofine CP} &= 7. 0. - - - 9,996751 \\ - \text{Rad.} = \text{Cofi. AC} &= 87^{\circ}. 8'. 20'' = 8,698340 \end{aligned}$$

$$\begin{aligned} \text{Rad.} + \text{Sine } 7^{\circ}. 0' - - - 19,085895 \\ - \text{Sine } 87^{\circ}. 8'. 20'' - - - 9,999458 \\ = \text{Sine} - - - 7^{\circ}. 1'. - 9,086437 \\ \text{Sub. from } 23. 28 \text{ obliquity of the ecliptic,} \\ \text{Rem. } 16^{\circ}. 27' \text{ Sine, } 9,452060 \\ + \text{Sine} - - 87. 8. 20'' 9,999458 \\ - \text{Rad.} = \text{Sine } 16. 26 = \text{CR} = 9,451518 \end{aligned}$$

$$\begin{aligned} \text{Rad.} + \text{Cofi. } 87^{\circ}. 8'. 20'' 18,698340 \\ - \text{Cofine} - - 16. 26. 9,981886 \\ = \text{Cofine AR} = 87. 1 8,716454 \end{aligned}$$

Which subtracted from 360, leaves  $272^{\circ}. 59'$ . right ascension.

	Right ascension.	Declination South.
Therefore, by calculation from } the theory, we have	$272^{\circ}. 59'$	$16^{\circ}. 26'$
But by Mr. Messier's observation,	$272 \quad 57\frac{1}{2}$	$15. 55\frac{1}{2}$
The difference in right ascension is,	$0^{\circ}. 1\frac{1}{2}$ and	$0^{\circ}. 30\frac{1}{2}$ in declinat.

HENCE it appears, that the observation of M. Messier entirely agrees with the magnitude I had assigned the Comet's orbit, and likewise with the time and place of the perihelion; but the inclination of the orbit ought perhaps to be encreased four or five minutes.

I am,

Ever yours, &c.

D. RITTENHOUSE.

December 2, 1770.

To Rev. Dr. SMITH.

P O S T S C R I P T.

MR. RITTENHOUSE, when he wrote his first Paper, expressed his hopes of obtaining a further confirmation of his theory, of this COMET's motion, by seeing it on its ascent from the *perihelion*. But it was not then seen (so far as we have yet heard) by any person in America. This disappointment, however, he did not ascribe to any defect in a theory which he had endeavoured to establish from the best principles, and with great labor of calculation, but to the difficulty of finding a body of such small size, in the Heavens; especially with such a large



unwieldy Refractor, as he himself was obliged to use. The account, therefore, of Mr. Messier's observation, who saw the Comet ten or twelve days sooner than we did here, being so acceptable to him, (as it gave a further opportunity of confirming his theory by the above Paper of December 22d) I imagined that any account of the *Comet*, after its return from the Sun, would be still more acceptable; and therefore, when the Gentleman's Magazine, for August last, fell into my hands, I lost no time in sending him the following, viz.

“ THOUGH we were not lucky enough in America to discover the late Comet in its ascent from the Sun, yet I have the pleasure to acquaint you, that it was seen in England. I find, in the Gentleman's Magazine for August, that Mr. Six says, he had the *unexpected* pleasure (to you it would not have been *unexpected*) of seeing the COMET on its ascent from the SUN towards its APHELION, and tho' not visible to the naked eye, yet with a Telescope magnifying 25 times, it appeared much like the Nebula in *Andromeda's* Girdle. Aug. 22d, half past two, *mané*, it had  $106^{\circ} . 20'$  right ascension, and  $21^{\circ} .$  N. declin. The two succeeding days its longitude increased daily  $1^{\circ} . 15'$ . but its latitude both days not more than  $5'$ . Its apparent motion, he says, was nearly parallel to the ecliptic. If these subsequent observations agree as well, as Mr. Messier's previous observations, with your theory of this Comet, I think it will thereby be established past doubt. I am yours, &c. WILLIAM SMITH.”

*Mr. RITTENHOUSE's Answer. Dec. 26th, 1770.*

I WAS favoured with your extract from the Gentleman's Magazine, for August, by which I find Mr. Six was lucky enough to discover the Comet with his Telescope, after it had past its perihelion, though it was not visible to the naked eye. I have computed the Comet's place to August 22d, half past two in the morning, and make its right ascension  $108^{\circ} . 46'$ . with  $21^{\circ} . 0'$  North declination; agreeing with Mr. Six's observation entirely in declination, but differing from it about  $2^{\circ}$ . in right ascension, which I cannot think material, unless I knew what method he took to determine the right ascension of a heavenly body, out of the meridian.

D. R.

N. B. In the *Parabolic Trajectory* of this COMET (Plate I. Fig. 2.) suppose that part, from A to B, a little elevated above the plane of ecliptic ; and the remainder, from B to C, as much depressed below it ; the two planes intersecting each other in the line of the nodes, at an angle of  $1^{\circ}. 49$  .

*Some Account of the same COMET, in a Letter from the Right Honorable WILLIAM EARL OF STIRLING ; to WILLIAM SMITH, D. D. Provost of the College of Philadelphia. Communicated to the Society, Aug. 17th, 1770, viz.*

*Baskenridge, June 29, 1770.*

DEAR SIR,

YOU have reason to think me negligent in not communicating (according to my promises, to you) my Observations of the last TRANSIT OF VENUS. I now send them \*, and you should have had them before, but I have been so much engaged in business the last twelve months, that I have had but little time to think of any thing else.

LAST night, about ten o'clock, I discovered a *New Star*, about  $78^{\circ}$ . distant from the pole. It would pass the meridian, I imagine, about midnight, and a little before Lyra. Its appearance was larger than a Star of the first magnitude, of a dull light, with a bright speck or nucleus, in the center. I take it to be a COMET, and that its tail is from us. But whether it be a Comet or not, will be determined in a few days ; for as it changes its place, and the Earth moves on in its orbit, the position of the tail, with regard to the Earth, must be altered, and will then appear to encrease in length.

JUNE 30th. Last night I again observed the new discovered Star. Its appearance was much as it was the night before, but I think rather larger. Its situation was about  $70^{\circ}$ . from the pole, and it passed the meridian with Lyra almost half after eleven.

\* They are inserted above, P. 20, Appendix.